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Changes in Effort, Catch-per-unit-effort and Biological Characteristics in the Inshore Herring Fishery at the Magdalen Islands (1970-1980)

by

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Abstract

A questionnaire survey was run in 1980 in the Magdalen Islands to determine any recent change in inshore fishing effort and catch per unit of effort in the herring fishery. Additional biological information concerning herring caught by traps was also obtained from the St. Andrews Biological Station.

The results of the survey show that the total gill net fishing effort, measured in net-days, has gradually increased from 1970 (31000 net-days) to 1980 (77000 net-days). The increase in total gill net effort were due to a rise in the number of licensed fishermen, as well as to an increase in the total number of nets set per fishermen. The relative stability of the gill net CPUE indices from 1972 (58 lb/n.-day) to 1980 (48 lb/n.-day) calculated with individual catch and effort data cannot be taken as evidence that herring abundance is stable due to many reasons such as: with the increasing demand for herring, and the apparent decline in abundance (observed in the NAFO division 4T by Winters and Moores, 1979, the fishing pattern could have changed from a more or less randomly distributed effort to a fishing effort directed on concentrations of herring, thus keeping the catch rates artificially high.

The number of traps in operation in the Magdalen Islands has been relatively consta through the years. Trap catch was almost exclusively composed of spring spawners, and the age composition samples show an increase in the proportion of young fish (less than 6 years old) in the trap fishery. There appears to be a slight increase in length at age for certain year-classes since 1973, and relative growth rates of 5 to 10+ years old are greatest from 1979 to 1980. A drastic reduction of CPUE indices (in t/trap) between 1971 (329 t/trap) and 1980 (2 t/trap) indicates a decrease in fishable herring biomass.

Résumé

Une enquête par questionnaire écrit a été entreprise aux Iles-de-la-Madeleine en 1980, afin de déceler des fluctuations possibles de l'effort de pêche côtière au hareng, et de la prise par unité d'effort. Des données biologiques concernant le hareng capturé dans les trappes des Iles-de-la-Madeleine ont été obtenues de la Station biologique de St. Andrews, N.-B., pour compléter notre étude.

Les résultats de notre enquête ont démontré que l'effort total de pêche des filets maillants, mesuré en filet-jour, a augmenté graduellement de 1970 (31000 filets-jours) à 1980 (77000 filets-jours). Cette augmentation de l'effort est due au nombre croissant de pêcheurs licenciés, ainsi qu'à l'utilisation d'un plus en plus grand nombre de filets par chacun des pêcheurs licenciés. Un indice d'abondance du hareng, calculé à partir des données de capture et d'effort de pêche de chacun des pêcheurs ayant répondu au questionnaire, semble relativement stable durant la période 1972 (58 lb/filet-jour) - 1980 (48 lb/filet-jour). Cependant, cet indice de prise et d'effort ne peut être considéré comme représentatif de la stabilité de l'abondance du hareng pour certaines raisons telles que: puisque la demande de hareng est de plus en plus forte et son abondance diminuant (Winters & Moores, 1979), l'effort de pêche, autrefois distribué plus ou moins au hasard, pourrait être maintenant dirigé sur les concentrations de poissons, contribuant ainsi à garder artificiellement constants les taux de capture.

Le nombre de trappes en opération aux Iles-de-la-Madeleine est demeuré relativement constant depuis 1970. Les captures de cet engin de pêche sont composées presque exclusivement de harengs qui frayent au printemps. L'analyse des échantillons de hareng montre clairement l'importance croissante des jeunes harengs (moins de 6 ans) dans la pêche. Il semble également qu'il y aurait eu une légère augmentation dans la longueur à l'âge des harengs depuis 1973, et que le taux relatif de croissance des poissons âgés de 5-10+ ans aurait été maximum en 1979 et 1980. Les prises par unité d'effort de pêche à la trappe ont diminué de façon drastique depuis 1971 (1971: 329 t/trappe; 1980: 2 t/trappe) et indiqueraient une baisse dans la population de hareng disponible pour la pêche.

Introduction

The following document is a summary of a study on the herring trap and gill net fishery in the Magdalen Islands. The main purposes of the study were to determine the fishing effort exerted by these two gears on the herring stock and to detect changes in the population. The information was collected through a questionnaire survey run in 1980, and completed with biological data provided by the St. Andrews Biological Station.

Gill net fishery

A total of 460 questionnaires were mailed to all the herring gill net fishermen licenced in 1980 in the Magdalen Islands. English and French versions of the questionnaire were available to the gill net fishermen, but all the trap fishermen being francophone, only a French version of the trap questionnaire was sent out (Tables 1a and 1b); the questions were primarily designed to estimate the herring fishing effort from 1970 to 1980. A total of 88 questionnaires (19%) were returned completed.

1) Gill net landings

Prior to 1977 most of the herring catch was used as lobster bait or for personal use and hence was not recorded anywhere (M. Cyr, Chief of protection, Direction des pêches maritimes at Cap-aux-Meules; personal communication). For this reason, reported total herring catches for the gill net fishery are scarce before this date and cannot be used with reliability to calcultate CPUE indices (Table 2). Even in 1980, almost all fishermen (88%) used some herring as bait which consequently was not included in the landings (Table 3). Each fisherman was asked to provide us with his annual catch, if desired. Those landings data were used later on in the calculation of herring abundance indices.

2) Fishing experience

Most of the fishermen who answered our questions were recent entrants to the herring fishery, with more than 40% having fewer than 5 years experience (Table 4). It is possible that younger fishermen are more literate and also more conscious of the importance of fishery management, than older fishermen, and for this reason are willing to cooperate. However it is impossible to calculate if the response rate to the questionnaire is really higher for young fishermen.

3) Number of herring gill net licences

In 1979 and 1980, the number of fishermen and nets licenced was recorded at the Quebec Ministry of Industry and Commerce. Prior to 1978 it is believed that herring was only fished as lobster bait with an average of 2 nets per fisherman (M. Cyr, Chief of protection, Direction des pêches maritimes at Cap-aux-Meules; personal communication). The year 1978 was a transitional one, during which some people began fishing herring for purposes other than for bait. The estimated number of herring gill nets from 1968 to 1978 and the total number of licenced nets for 1979 and 1980, (Table 5) show a large increase over the last two years. In order to determine whether or not all these licenced gill nets were used, we calculated the percentage of utilization by comparing the number of nets for which a given fisherman has licences, with the number of nets he actually set, as reported on returned questionnaires. More than 60% of the fishermen in 1979 and 1980 set 100% more nets than for which they had permits (Table 6). Evidently, any fishing effort calculation based on permits would have underestimated effort.

4) Size of gill nets

Except for a slight increase in the use of longer (16-25 fathoms) and deeper (16-20 feet) nets, there has been no major change in the dimensions of nets from 1970 to 1980, with average length and depth around 16.5 fathoms and 11.2 feet respectively (Table 7 and 8).

5) Mesh size

Over the last decade increasing use has been made of gill nets with a stretched mesh size between 2 5/8 - 3" although mesh sizes from 2 1/8" - 2½" have always predominated (Table 9).

6) Frequency of visits to nets

Most fishermen visit their nets once a day, 5 or 6 days a week. Of all the 88 fishermen who answered the questionnaire, only 6 reported visiting their nets twice a day.

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7) Number of nets per fisherman

The average number of gill nets per fisherman has more than doubled between 1970 and 1980, passing from 3.2 to 7.6 nets (Fig. 1). The number of fishermen using a given number of nets (Fig. 2) shows that in the early seventies, most fishermen used from 1 to 4 nets while later in the decade, most had between 4 and 8 nets. Moreover the proportion of fishermen with more than 10 nets has increased 8 fold between 1977 and 1980. These data indicate a considerable increase in the fishing effort over the last 10 years.

8) Fishing season

Survey results indicate that the opening and closing dates of the herring fishing season were stable from year to year, commencing around April 24th and terminating around June 6th (Table 10). There was no mention of a fall fishery in the Magdalen Islands. However caution must be exercised in the interpretation of these results since fishermen tend to report the same dates year to year possibly since they cannot remember the exact dates.

9) Number of days fishing

The number of days (Table 10) spent fishing herring was constant from 1970 to 1980 averaging 26 days. The respondants of our questionnaire tended to report the same number of days for each year, perhaps because they could not recall exactly.

10) Effort indices

A fishing effort index was calculated in two ways:

a) From the questionnaires, whenever available, the number of days a fisherman fished during a year was multiplied by the number of nets he set during that same year. An average was then calculated for all the respondants fishing effort data. Results (Table 11) show a 140% increase in effort from 69.8 net-days in 1970 to 167.7 net-days 1980. This index was multiplied by the number of licended fishermen to estimate the total fishing effort in one year (Table 12). An increase of 148% in the total effort is observed from 1970 to 1980.

b) The average number of nets per fisherman per year was multiplied by the mean number of days fished per fisherman per year to obtain an effort index in net-days (Table 13). This index was then multiplied by the total number of fishermen licenced in order to estimate the total effort of the herring fishery (Table 14). The calculations of these effort data could be more biased than in the previous case, since they use overall means, instead of individual answers, with the advantage of including a bigger set of data. Again, results show an increase in effort by more than 150% from 1970 to 1980.

11) CPUE indices

The CPUE index was calculated in two ways:

1) A catch per unit of effort index (Table 15) was calculated for each year, by dividing each fisherman's annual catch by his corresponding fishing effort (net-days). Average CPUE calculated were 100 (lb/net-day) in 1970 decreasing to 57.7 (lb/nets-day) in 1980. The CPUE index was stable from 1973 to 1978, increased in 1979 and finally decreased in 1980. The small number of replies for 1970 to 1975 makes interpretation of trends difficult.

2) A second CPUE index (Table 16) was derived by dividing the total annual landing (lbs) as recorded by Fisheries & Oceans inspectors, by the total fishing effort in net days (Table 14). Since most of the catch prior to 1977 was used as lobster bait records are scarce. The CPUE index has increased from 1977 to 1979 going from 2.3 to 35.0 and then dropped to a value of 27.1 lb/net-day in 1980.

Discussion

Fishing effort as measured by the total number of net-days has apparently increased gradually from 1970 to 1980. This trend is partially due to an increase in the number of licenced fishermen during the 1978 - 1980 period and it exists in spite of a decrease in their numbers from 1968 to 1977. Increases in the total effort can be also partly explained by increases in the total number of nets set and in the average number of nets per fisherman. The fact that 40% of those who replied to our questionnaire had fewer than 5 years

fishing experience also suggests that the fishing effort has recently increased. Effort may be increasing in response to improved markets for herring products prevailing since 1978 (Greendale & Powles) or may indicate decreased herring abundance.

From the present survey it is difficult to draw firm conclusions concerning the temporal evolution of the annual catch per unit effort indices (CPUE) calculated with individual fishermen's answers. These indices (Tables 15 and 16) are probably more or less reliable due to the following biases:

i) they are based on the landings of a limited number of fishermen. Many individuals, perhaps those with small annual catches did not reply to either the questionnaire or the question concerning landings. Catch data from 1970 to 1975 are only based on from one to seven questionnaires.

ii) fishermen tended to give the same answer for each year of the survey.

The relative stability of this CPUE index (Table 15) from 1976 to 1980, in spite of increased fishing pressure, cannot therefore be taken as evidence that herring abundance is stable. The increasing demand for herring as well as the raise in market value could lead the fishermen to select their fishing area more carefully now than ever. Historically, fishermen would set their nets more or less at random (near their homes or wharves) since herring were abundant everywhere. More recently, herring being more scarce, it has probably been advantageous for the fishermen to set their nets where the fish concentrate, i.e. on spawning beds. Greendale and Powles (1980) actually found that a high proportion of fixed gill net fishermen used spawning beds as a criterion for placing their nets. All of this could easily contribute to keep the catch rates constant with time, in spite of the apparent decline in overall fish abundance noted by Winters and Moores (1979).

For the years (1977 to 1980) for which we have reports on the total landings of herring for the gill net fishery, there seems to be an increase in the catch per unit effort (Table 16) until 1979. The exact reasons for this apparent trend are unknown, but an obvious reason could be the improvement with time of the data collection system: the proportion of catch reported would then have increased with time, raising artificially the CPUE values.

Trap Fishery

The herring trap fishery offers several advantages over other commercial fisheries for the study of herring. Firstly, the effort of the trap fishery has remained relatively constant over the last decade and is more easily

quantifiable than for any other gear. Traps are fixed gear and there has been no marked increase either in their numbers or in their efficiency due to changes in design (size, shape, mesh size) or fish search techniques (Spénard, 1979). Secondly, since no discarding of fish is practiced by trap fishermen (H. Cyr, personal communication) and since there is a commercial trap fishery for which landing data are available, an estimate of catch and ultimately catch per unit effort (CPUE) can be easily obtained. Thirdly, traps are less size selective than gill nets and thus sampling of the herring population is more representative.

Description and location of traps

All traps in the Magdalen Islands are constructed of cords, nets and floats and consist of two parts: a leader serving to direct fish and an enclosure park from which they cannot escape. Traps are of two types depending on whether or not the enclosure has a bottom net. Bottomless traps average 290-300 m in perimeter and 7-9 m in depth while the corresponding dimension for traps with bottom nets are 100-200 m and 4-6 m. For both types, the leader measures from 225 to 290 m. While there are no regulations concerning the mesh size of the park, most are between ¾" and 1½". Before 1975, the streched mesh size of the leader had to exceed 4" but even though no restrictions are now enforced, few meshes are under this limit. The location of nets around the Magdalen Islands is shown in Figure 3. A more detailed description of the type and location of traps used in the Magdalen Islands is published elsewhere (Spénard, 1979).

Trap landings

Spénard (1979) presents in his document the total landings for the Magdalen Islands from 1970 to 1978. Between 1910 and 1966, most, if not all, the landings were from the traps, and averaged 6000 t. In 1966, the purse seiners were introduced in the southern gulf fishery, and contributed to the total herring catch. However, from 1967 to 1969, the total trap landings are estimated to be over 14000 t. Landings data for the trap fishery only are available for the period 1970 to 1977 from the Fisheries and Oceans, Statistical Branch in Halifax, and from 1978 to 1980 from the Inspection office of Fisheries and Oceans in the Magdalen Islands. There has been a gradual but dramatic decrease of 99% in herring landings, from 1971 to 1980 (1970: 4711 t, 1980: 40 t) (Table 17), and preliminary catch information for 1981 indicates less than 1 t for the total catch.

Catch samples

During the spawning season (late April to mid June) of each year, random samples of herring caught by trap fishermen (1973-80) were taken by the St. Andrews laboratory. The following observations are based on these samples:

1) Proportion of spring and fall spawners

Random samples show that herring are predominantly spring spawners. Maximum proportions of fall spawners were in 1974 and 1979 when they represented 6 and 7 percent of the catch respectively (Table 18).

2) Length frequency

The length frequency graphs (Figure 4) for herring are unimodal from 1973 to 1975 and are dominated by longer (32-35 cm), perhaps older, fish while the graphs for later years are multimodal with smaller size classes being present. The above data tend to show that the fishable population was younger during the 1977 to 1980 period than during preceeding years.

One can follow the dominant length group from 1973 until its disappearance from the trap fishery in 1979. These fish could well represent the abundant 1966 year-class. The 1974-1975 year-classes (27-30 cm), which predominate in the 1979 fishery of the Magdalen Islands according to Winters and Moores (1980), were not present in our length frequency samples until 1980.

3) Length at age was determined and the relative rate of growth (Ricker, 1975) for each cohort was calculated using the equation:

$$\frac{l_2 - l_1}{l_1} \times 100$$

where l_1 and l_2 are the mean total lengths of successive year-classes.

The mean total length at age and the relative rates of growth are shown in Tables 19 and 20 respectively. For a given age, mean total length tended to increase slightly from 1973 to 1980 for older age classes (5 to 10+). The relative rates of growth of cohorts suggest that fish, especially 5 to 10+ years old grew faster from 1979 to 1980 than during preceding years.

4) Mean weight

The mean weight of a fish caught was calculated by averaging for each year, the individual weights of fish from the biological samples. No trend was noticed for the mean weight between 1973 and 1980 (Table 21).

5) Numbers at age

The number of fish caught annually from 1973 to 1980, was estimated by dividing the total weight of the annual landings by the average weight of individual herring for each year. Then the total number of fish was apportioned to each age class according to the distribution of fish in the age-length key. These numbers at age are also expressed as a percentage of total annual catch (in number) in an age composition matrix for the 8-year study (Table 22).

The mean age of herring in the catch has decreased, averaging 7.9 years for the period 1973 to 1976 and 6.1 for 1977 to 1980. The age composition data show that fish spawned in 1966 and 1974 are the dominant year-classes in the catch from 1973 to 1974 and 1977 to 1980 respectively. As stated earlier similar results were found by Winters & Moores (1980). From the age composition table, it is also evident that fish younger than 6 years old made a greater contribution to the fishery from 1977-1980 than from 1973-76.

Fishing effort and abundance index

The fishing effort for each year (1970-1980) estimated from the number of traps in operation (trap-year) (Table 23) has diminished slightly since 1973 but not nearly enough to explain decreased landings. In spite of recent improvements in the herring market, effort has not been augmented. For each year except 1978, at least 90% of all traps for which fishermen held licences were used.

CPUE

Temporal change in catch per unit effort (CPUE) was determined by dividing annual landing data (t) by the number of trap-years. Each trap was assumed to represent an equivalent unit effort even though the location and type of trap (bottomless or not) may have influenced their efficiency (Spénard, 1979).

Since the fishing effort has recently increased, a decrease in the fishable herring population could adequately explain the radical 98% diminution in catch per unit of effort since 1973 (Table 24). However one cannot exclude some other causes for a drop in CPUE, like a shift in the spawning location of herring, the interference created by the numerous gill nets set often farther ashore than the traps etc.

Discussion

An examination of the results reveals the following trends in the biological data.

a) Length frequency and age composition data confirm that there has been in recent years, an increase in the importance of younger (less than 6 years old) fish to the trap fishery. This shift in the age structure of the population may result from heavy fishing pressure or from improved recruitment at ages less than 6 years. The absence of the abundant 1966 year-class from the fishery after 1978 also enhances this tendency.

b) While fish caught from 1977 to 1980 are on average 2 years younger than those captured from 1973 to 1976, there is no evident downward trend in yearly average weight of herring, which could suggest that fish of a given age are now heavier.

c) There is a slight tendency in certain age classes (5-10+) towards increased length from 1973 to 1980. For example, 9 years old caught in 1973 are smaller than 9 years old caught in 1980.

d) Growth rates of the 5 to 10+ years old are greatest from 1979 to 1980. Environmental conditions (such as food abundance and meteorological factors) could possibly explain this event as well as compensatory growth.

e) The drastic reduction from 1973 to 1980 in the CPUE could indicate a decrease in herring abundance and is coherent with the decline in trap CPUE found by Powles et al. (1979) for the period 1970 to 1980. The mortality of older fish, due to such factors as overexploitation, and the absence of good recruitment of younger fish, probably best explain the changes later in the decade, in the age structure and length frequency distribution of the herring population.

Conclusion

In the Magdalen Islands, herring gill net fishing effort has apparently roughly tripled over the last ten years, resulting in an increase in reported landings. But scarce and dubious data make very hazardous the interpretation of any abundance index for this fishery. However, the fishermen from the Magdalen Islands generally agree on the recent decline in herring abundance, and many of them complain about the increase in fishing effort (see Appendix). The trap herring fishery has shown a constant fishing effort pattern through the years. The abundance index for the trap fishery has dropped by a hundred folds between 1970 and 1980. These facts, combined with some biological evidence found in the analysis of the trap catch, could indicate that the fishable herring biomass has now reached its lowest level since 1970.

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APPENDIX

FISHERMEN'S COMMENTS ON HERRING FISHING SUCCESS (FROM QUESTIONNAIRES)

Le hareng a beaucoup diminué au cours des ans. Il est pêché trop tôt par les seineurs, ce qui fait qu'il n'a pas le temps de frayer et de se rendre dans la baie de Plaisance. On seine le hareng au Rocher aux Oiseaux.

Je pense que la pêche au hareng est un succès. Cependant, je crois qu'il devrait y avoir une limite au nombre de filets qu'ont les pêcheurs de homard. Cela donnerait une chance aux pêcheurs qui dépendent uniquement de la pêche au hareng.

La pêche au hareng semble meilleure depuis les dernières années.

Les captures de hareng ont diminué considérablement avec les années pour les pêcheurs côtiers.

La pêche au hareng diminue avec les années.

Les captures ont toujours baissé.

Aux Iles-de-la-Madeleine, il y a trop de filets à la mer. Cela détruit le hareng. Je pense que deux filets par pêcheur seraient l'idéal.

Il y a trop de filets tendus dans la baie de Grande Entrée. Ce barrage enpêche le hareng de circuler dans la baie et de se rendre à Pointe-au-Loup. Avec tous ces filets, bien du hareng est perdu, parce qu'on ne peut visiter tous les filets en une seule journée.

Il n'y a pas de hareng qui entre dans la baie de Plaisance ou près des côtes, car il y a un trop grand nombre de bateaux (seineurs) qui pêchent au large des côtes.

Depuis 1970, le hareng a diminué énormément.

Il y a une légère amélioration depuis que la pêche a été réglementée. Mais s'il y avait plus de réglementation pour cette pêche, les pêcheurs côtiers en seraient plus avantagés.

Depuis 10 ans personne n'a de succès dans la pêche au hareng. Je pense que les seineurs de hareng qui vont au Rocher aux Oiseaux détournent le hareng qui viendrait frayer.

Il n'y a plus beaucoup de hareng. Il est pris par les gros bateaux avant d'arriver aux Iles.

Depuis que les seineurs viennent dans le Golfe, le hareng a beaucoup diminué.

Le succès de pêche au hareng varie selon la température, glace, etc., et aussi selon les conditions d'achat. Nous avons dû rester longtemps à terre sans pêcher pendant des jours parce qu'on ne nous achetait pas le hareng.

On devrait imposer une limite au nombre de filets qu'ont les pêcheurs de homard. Certains pêcheurs de homard ont 30 et 40 filets à hareng. On devrait aussi arrêter les seineurs qui pêchent près de nos côtes, par exemple au Rocher aux Oiseaux. Ils détournent le hareng qui vient aux Iles.

Cette année, 1980, le hareng fut très abondant. Malheureusement, il s'en est allé tout d'un coup, en l'espace de deux jours.

Je pense que la baie du Havre-aux-Basques devrait être ouverte. Cela favoriserait sans aucun doute la pêche au hareng.

Il semble que les prises de hareng ont augmenté dans l'est des Iles. A l'ouest des Iles, il a considérablement diminué. Mais le nombre de filets a triplé. Je me demande ce qui arrivera quand tous les pêcheurs auront 15 à 20 filets. La pêche au hareng durera une semaine et ce sera fini. Peut-être qu'on prendra la même quantité de hareng, mais en moins de temps.

En 1980, le hareng a été plutôt rare pour les pêcheurs côtiers.

Je trouve que ça diminue terriblement.

Le hareng diminue d'année en année.

Pêche très minime pour les pêcheurs côtiers.

Je pense que le "presque succès" obtenu cette année est dû aux trois ou quatre jours de tempête pendant lesquels les seineurs n'ont pas arrêté les harengs d'entrer dans la baie de Plaisance.

Il y a eu une baisse de hareng au cours des 12 dernières années.

There are fewer herrring now. In the past 10 years fishermen have caught fewer.

The herring catches are decreasing every year. You cannot get enough herring to last the lobster season. So you either have to buy them back or drag for another kind of bait.

I think there are more herring now than in the past years because the herring seiners are not allowed to fish in the bays as close to the shore where herring spawn.

Now there are a lot fewer herring. There are too many nets fishing and the seiners catch the females offshore before they reach inshore and spawn. The way it is now, there is no future for herring.

There are fewer herring because of poor management of the herring seiners and an increase in the seal herd.

There are fewer herring.

There are fewer herring due to overfishing.

There are fewer herring because of the large vessels fishing inshore.

There are fewer herring because the big seiners catch them all before they come inshore to spawn..

Less herring.

There is about the same amount of herring as 10 to 15 years ago, but like every other species of fish, it is overfished. There are too many fishermen.

There are fewer herring now because of the overfishing by the large seiners. The herring do not have a chance to spawn. I think that the season for the seiners begins too early in the spring. They should not be allowed to fish until the herring are well up in the Gulf coast to the land where the seiners cannot get them.

There are fewer herring. One net fishing herring in 1956 was better than 9 nets in 1980.

The herring fishery is getting worse every year. There are not going to be any fish to catch in a couple of years, if no quota is put on the number of nets. There should only be three nets per captain.

Herring have been less abundant over the past 15 years. The seiners are drastically reducing our catch.

There are fewer and fewer herring each year due to seiners and the use of too many gill nets.

In 1980, there were fewer herring firstly because the weather was bad, and secondly because there were too many nets set. Also, the seiners are fishing in the Gulf. The big seiners take a lot of the fish before the spawn. There shoud be a limit on number of nets in the Bay. Some fishermen have too many nets.

There are now fewer herring due to overfishing. In the past years the herring came into Grande Entrée to spawn off the shoal water areas. In 1980, I believe we caught the herring before they reached to shoals as there was very little or no roe in the water. Ten years ago there was very little, if any, commercial fishing for herring in the Grande Entrée Bay and we had no problem to catch herring for bait until late May.

In 1980, the fishing effort in Grande Entrée doubled or maybe tripled over that in 1979. Most boats used 12 to 15 gill nets. In fact, the Bay was full of nets. Surely, this was over-fishing and was one, if not the only reason, why there were no herring in this area in May 1980. I think that the lagunes and Bay of the Magdalen Islands should be closed to commercial fishing for a number of years to allow the herring to come back. Fishermen should be allowed to fish herring only for bait.

There are fewer herring now because there are too many herring seiners catching them before they spawn. Also, the smaller boats have too many nets. There should be a limit to the number of nets each boat can have.

In six years, the herring catch has decreased per boat and net, because the number of boats and nets has increased three fold.

Over the past six years the herring fishery seems to be the same. However, in comparison with 25 years ago there is a big decline in catch per boat.

The herring fishery has declined in the last 10 to 15 years largely because of too many nets per boat. My suggestion is to limit the number of nets to 5 per

boat and not to open Grosse Isle Bay to herring fishing until the 1st May in 1980. I only got enough bait for the first day of the lobster season. Some other years you could fish herring until around the 1st of June.

The herring fishery has been really bad during the last 10 to 15 years. There are fewer herring now than there were before and this is due to overfishing by the seiners.

There are fewer herring now than there were 10 years ago. The herring do not have a chance to spawn because the seiners catch them in the Gulf. I think that if the seiners are allowed to continue the way they have been in the past, herring fishing in the Magdalen Islands will be over in a few years.

Herring never laid eggs for the last 3 years. They are all caught before spawning. If the fishery is not closed, it should be restricted to bait, or a limit should be put on the number of nets per boat. Some boats are fishing 25 to 45 nets. If you do not do something, there is not going to be a herring left to catch.

In the past 10 or 15 years herring have been declining in number.

In the past 10 or 15 years herring are less and less abundant. Before herring were numerous around the Islands. There was no end to them during the month of May. In the 1960's these Islands were invaded by herring seiners from the West and East coasts equipped with electronic equipment. They caught every herring that entered the Gulf. What they did not carry they dumped until they were stopped about 5 years after. They split up the schools and drove the fish wild so that few came near enough to the traps to be caught. Until this is stopped fewer and fewer herring will come to the Islands to spawn.

Table 1a. Questionnaire sent to the herring gill net fishermen of the Magdalen Islands in 1980.

HERRING SURVEY

GILL NETS

CONFIDENTIAL

The following questionnaire is designed to determine how your fishing effort has changed over the years. Please try to answer as accurately as possible starting with 1980. NB: In our examples below we consider having set 30 herring gill nets during the fishing season. Thank you for your cooperation.

1. How many years have you fished herring?

_____
_____
_____

2. Where did you set your herring gill nets in:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

3. How many herring gill nets did you set including those used only to catch bait, in:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

4. What was the length (in fathoms) and depth (in feet) of each of your gill nets (once set). e.g.: 25 nets measuring 15 fathoms long by 15 feet deep and 5 nets measuring 13 fathoms long by 15 feet deep.

1980_____

1979_____

1978_____

1977_____

1976_____

1975_____

1974_____

1973_____

1972_____

1971_____

1970_____

5. Which mesh size (once stretched) in inches did you use most often in:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

6. On which date (s) did you set your herring gill nets? If you set them on more than one occasion indicate the number of gill nets set at each date. e.g. 10 nets set on April 12th and 20 nets set on April 17th.

1980 _____
1979 _____
1978 _____
1977 _____
1976 _____
1975 _____
1974 _____
1973 _____
1972 _____
1971 _____
1970 _____

The following questions will let us know the number of days during which your herring gill nets were in the water actually fishing.

7. Did you ever lose any herring gill nets? Yes ( ) No ( ).
If yes indicate the number of herring gill nets lost for good and the date on which you lost them. e.g. 5 gill nets lost on May 5th and 2 nets lost on May 7th, 1980.

	Number of nets	date
1980		
1979		
1978		
1977		
1976		
1975		
1974		
1973		
1972		
1971		
1970		

8. Did you ever find any of your herring gill nets so damaged that they could not be used again during the fishing season? Yes ( ) No ( )
If yes, indicate how many nets and on which date you found them to be damaged.

	Number of nets	date
1980		
1979		
1978		
1977		
1976		
1975		
1974		
1973		
1972		
1971		
1970		

9. At the end of the fishing season, on which date did you remove your herring gill nets? Also include gill nets used to capture lobster bait. e.g. 20 nets were removed on June 10th and 3 were removed on June 25th.

1980	
1979	
1978	
1977	
1976	
1975	
1974	
1973	
1972	
1971	
1970	

10. On how many days during the herring fishing season were you unable to visit your gill nets due to bad weather or for other reasons? Include Sundays if you did not fish.

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

11. On how many days during the fishing season did you visit your gill nets in:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

12. How many times a day did you visit your herring gill nets during:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

13. Do you fish herring for: (check the appropriate boxes and/if possible indicate a %)

Bait for yourself	( )	_____ %
Bait sold to other fishermen	( )	_____ %
Food for yourself, friends or relatives	( )	_____ %
Sale for local consumption	( )	_____ %
Sale to processor	( )	_____ %
		100%

14. Could you indicate (only if you wish) your total catch (in pounds) in:

1980 _____ 1974 _____

1979 _____ 1973 _____

1978 _____ 1972 _____

1977 _____ 1971 _____

1976 _____ 1970 _____

1975 _____

15. If you wish give your comments on how the herring fishery has been doing during the last 10 to 15 years. Do you think there are now more or fewer herring and why?

_____

_____

_____

_____

_____

_____

_____

_____

_____

NAME _____
(optional)

_____

ADDRESS _____

_____

Town where you unload your herring

_____

DATE _____

Thank you for your cooperation

Lynn Cleary
Biologist
Fisheries and Oceans
Gare Maritime Champlain
901 Cap Diamant
C.P. 15,500
Québec
G1K 7Y7

Table 1b. Questionnaire (French version available only) sent to the herring trap fishermen of the Magdalen Islands in 1980.

QUESTIONNAIRE SUR LA PECHE AU HARENG

TRAPPE OU BARRAGE _____

CONFIDENTIEL LORSQUE COMPLETE _____

Pouvez-vous nous fournir les renseignements demandés dans les questions suivantes, et ce, pour autant d'années que possible, en commençant par 1980. Même si seules les trappes sont mentionnées, chaque question concerne également les barrages que vous avez tendus.

1. Depuis combien d'années pêchez-vous le hareng à la trappe?

_____
_____
_____

2. Combien de trappe(s) avez-vous tendue(s) durant la saison de pêche en:

1980_____

1979_____

1978_____

3. Quelle était la longueur du guide (en pieds) de votre (vos) trappe(s) en:

1980_____

1979_____

1978_____

4. Quelles était la grosseur de la maille (en pouces) du guide de votre (vos) trappe(s) en:

1980_____ 1974_____

1979_____

1978_____

5. Quelle était la longueur du parc (en pieds) de votre (vos) trappe(s) en:

1980_____

1979_____

1978_____

6. A quelle date avez-vous posé votre (vos) trappe(s) en:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

7. A quelle date avez-vous enlevé votre (vos) trappe(s) en:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

8. Combien de jours avez-vous visité et trouvé votre (vos) trappe(s) en bon état c'est-à-dire qu'elle(s) avait(ent) effectivement pêché durant la nuit?

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

9. Combien de jours avez-vous été incapable de visiter votre (vos) trappe(s) (à cause du mauvais temps ou autre raison) inclure les dimanches:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

10. Combien de jours avez-vous trouvé votre (vos) trappe(s) assez endommagée(s) pour savoir qu'elle(s) n'avait(ent) pas pêché durant la nuit ou qu'elle(s) avait(ent) perdu tous les poissons capturés, en:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

11. A quelle(s) fin(s) sert le hareng que vous pêchez. (Cochez s'il y a lieu, et si vous le pouvez, indiquez un pourcentage)?

Boette pour vous-même	( )	_____%
Boette vendue à d'autres pêcheurs	( )	_____%
Consommation pour vous, votre famille, vos amis	( )	_____%
Vendue pour la consommation locale	( )	_____%
Vendue pour la transformation en usine	( )	_____%
		100%

12. Pouvez-vous (si vous le désirez) inscrire votre capture totale (en livres) de hareng en:

1980_____ 1974_____

1979_____ 1973_____

1978_____ 1972_____

1977_____ 1971_____

1976_____ 1970_____

1975_____

13. Inscrivez (si désiré) vos commentaires sur le succès de pêche au hareng au cours des ans.

_____

_____

_____

_____

_____

14. Pourriez-vous fournir des renseignements sur la pêche avant 1970?

OUI_____ NON_____

NOM_____ DATE_____
(facultatif)

ADRESSE_____ Ville où vous débarquez votre hareng:

_____ _____

Merci de votre coopération.

Lynn Cleary
Biologiste
Pêches et Océans
Gare Maritime Champlain
901 Cap Diamant
C.P. 15,500
Québec
G1K 7Y7

Table 2. Reported landing (000 lb)* of herring caught in the Magdalen Islands gill nets, from 1970 to 1980.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
0	0	19	0	0	?	0	81	627	2521	2383

* data from 1970 to 1974, 1976-1977 from the Statistical Branch, Fisheries and Oceans, Halifax, N.-S. data for 1975 are missing
data for 1978 to 1980 from the Inspection Office, Fisheries and Oceans, Magdalen Islands, Quebec.

Table 3. Percentage of fishermen using herring for different purposes (n=86) in 1980, as determined from questionnaires.

Use	% of fishermen
Bait for yourself	88.4
Bait sold	19.8
Food for yourself	44.2
Food sold	65.1
Sale to processor	10.5

Table 4. Number of years of experience of herring gill net fishermen of the Magdalen Islands, as determined by a mail out survey in 1980.

Number of years fishing	Number of fishermen	Percentage of fishermen
0-5	38	45
6-10	15	18
11-15	10	12
16-20	6	7
21-25	6	7
26-30	5	6
31-35	2	2
36-40	1	1
41-45	2	2

Table 5. Number of fishermen licenced and number of nets estimated (1968-78) or licenced (1979-80). From 1968 to 1978 the number of fishermen licenced is believed to be equal to the number of boats fishing for lobster and each boat is estimated to have had 2 nets. The number of nets and fishermen licenced in 1979 and 1980 is based on government records.

Year	No of fishermen	No of nets
1968	484	968
1969	471	942
1970	439	872
1971	421	842
1972	402	804
1973	354	708
1974	333	666
1975	321	642
1976	300	600
1977	301	602
1978	309	618
1979	441	1933
1980	459	3098

Table 6. Percentage of gill net permits used by fishermen of Magdalen Islands, in 1979 and 1980.

Percentage of permits used	Percentage of fishermen 1979	1980
0	4 (2)*	1 (1)
1-50	2 (1)	3 (2)
51-100	32 (16)	42 (28)
101-150	20 (10)	30 (20)
151-200	20 (10)	14 (9)
201-250	12 (6)	15 (1)
251-300	4 (2)	0
> 300	6 (3)	8 (5)

*( ) number of fishermen.

Table 7. Percentage of Magdalen Islands fishermen using a given gill net length for each year, 1970 to 1980.

Year	Length (fathom)						n*
	< 5	11-15	16-20	21-25	26-30	50	
1970	3	62	29	3		3	31
1971	3	60	31	3		3	32
1972	3	60	31	3		3	32
1973	3	60	31	3		3	32
1974	3	61	30	3		3	33
1975	3	56	32	3	3	3	37
1976	3	52	37	3	3	3	40
1977	2	51	36	7	2	2	45
1978	2	46	39	8	3	2	52
1979	2	45	37	9	5	2	64
1980	1	43	37	12	4	3	81

* number of observations.

Table 8. Percentage of Magdalen Islands fishermen using a given gill net depth for each year, 1970 to 1980.

Year	Depth (fathom)					n*
	≤ 5	6-10	11-15	16-20	21-25	
1970	7	32	43	4	14	28
1971	6	32	46	3	13	31
1972	6	32	46	3	13	31
1973	6	32	46	3	13	31
1974	6	31	47	3	13	32
1975	6	30	50	3	11	36
1976	5	32	47	4	12	41
1977	6	33	44	6	11	46
1978	5	32	43	11	9	56
1979	5	32	49	7	7	68
1980	3	38	44	7	8	90

* number of observations.

Table 9. Percentage of Magdalen Islands fishermen using a given gill net mesh size for each year (1970 to 1980).

Year	Mesh size (inches)				n*
	≤ 1½	1¾ - 2	2 1/8 - 2¼	2⅝ - 3	
1970		5	81	14	42
1971		4	83	13	47
1972		4	81	15	47
1973		4	80	16	48
1974		4	80	16	48
1975		4	78	18	51
1976		3	78	19	57
1977		5	72	23	65
1978		4	65	31	77
1979	3	3	62	32	94
1980	2	2	61	35	127

* number of observations.

Table 10. Start and end dates of the herring fishing season in the Magdalen Islands, as determined by a mail out survey in 1980. The average number of days spent fishing is also shown.

Year	Start date	End date	No. of days spent fishing
1980	23th April (78)*	5th June (82)	25.4 (73)
1979	24th April (52)	4th June (50)	26.1 (48)
1978	24th April (39)	5th June (32)	26.3 (36)
1977	25th April (34)	5th June (27)	26.4 (27)
1976	24th April (29)	8th June (20)	26.8 (23)
1975	24th April (25)	4th June (18)	24.6 (19)
1974	24th April (22)	7th June (15)	28.4 (17)
1973	24th April (22)	6th June (14)	29.2 (15)
1972	24th April (22)	6th June (15)	28.9 (15)
1971	24th April (22)	5th June (14)	28.2 (15)
1970	24th April (21)	6th June (12)	26.2 (13)

* number of observations.

Table 11. Average number of nets-days/fisherman spent herring fishing in the Magdalen Islands from 1970 to 1980, as determined by a mail out survey.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
69.8	81.5	89.5	96.0	98.9	87.4	114.6	116.9	149.2	150.4	167.7
(13)*	(15)	(15)	(15)	(17)	(19)	(23)	(27)	(36)	(48)	(74)

*( ) number of responses.

Table 12. Total fishing effort [1] in net-days ('000) for the Magdalen Islands, 1970 to 1980, as determined by a mailout survey.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
31	34	36	34	33	28	34	35	46	66	77

[1] nets-days/fisherman X no of fishermen.

Table 13. Average number of net-days/fisherman spent herring fishing calculated by multiplying the average number of nets by the average number of fishing days, for the Magdalen Islands from 1970 to 1980, as determined by a mail out survey.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
84.9	91.4	97.5	107.2	110.0	96.5	113.5	116.2	148.7	162.8	192.6

Table 14. Total fishing effort [1] in net-days ('000) for the Magdalen Islands, 1970 to 1980, as determined by a mailout survey.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
37	38	39	38	37	34	34	35	46	72	88

[1] average no nets X averages no days X no fishermen.

Table 15. CPUE index (lbs/net-day) for the herring gill net fishery in the Magdalen Islands, 1970 to 1980, as determined by a mailout survey.

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
100	100	57.7	57.7	46.4	45.9	56.1	53	52.1	60.4	47.7
(1)*	(1)	(2)	(2)	(4)	(7)	(9)	(11)	(19)	(36)	(64)

*( ) number of observations.

Table 16. CPUE index (lb/net-day) for the herring gill net fishery, based on the reported catch (lbs) divided by total effort in net-days (Table 14).

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
0	0	0.5	0	0	0	0	2.3	13.7	35	27.1

Table 17. Landings (t)* of herring caught in the Magdalen Islands traps, from 1970 to 1980.

	Year										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Landing (t)	4711	7234	3823	3000	2646	1651	1169	1800	605[1]	154	40

* data for 1970 to 1974, 1976 and 1977 are from the Statistical Branch, Fisheries and Oceans , Halifax, N.-S.
data for 1975 from P. Spénard, 1979
data for 1978 to 1980 from the Inspection Office, Fisheries and Oceans, Magdalen Islands, Quebec

Table 18. Percent of fall spawners in herring samples from traps of the Magdalen Islands. Total number of fish per sample is shown in brackets.

Year	%	
1973	0	(121)
1974	6.0	(700)
1975	0.2	(599)
1976	0.3	(699)
1977	0	(160)
1978	0.2	(1160)
1979	7.1	(1090)
1980	0	(200)

Table 19. Mean total length (mm) of year-classes of herring captured by trap fishermen of the Magdalen Islands.

Age class (years)	1973	1974	1975	1976	1977	1978	1979	1980
2	172.0(1)*	235.3(10)	--	--	228.0(1)	244.0(2)	241.0(10)	--
3	--	268.2(26)	219.0(12)	273.0(3)	270.5(29)	269.1(222)	266.0(66)	280.8(7)
4	275.7(3)	291.0(51)	294.6(36)	295.1(107)	295.7(13)	293.7(449)	293.5(159)	292.6(39)
5	296.6(17)	300.2(32)	311.5(18)	302.4(95)	311.1(20)	308.1(49)	308.8(392)	317.1(17)
6	314.8(45)	316.3(134)	317.6(36)	313.4(17)	321.6(5)	326.9(79)	321.3(34)	329.0(54)
7	326.4(43)	321.9(74)	327.3(155)	--	--	332.0(47)	337.4(97)	342.9(11)
8	335.8(17)	327.4(170)	330.3(64)	329.6(110)	--	340.6(39)	342.6(28)	352.0(13)
9	342.8(5)	330.5(122)	337.1(50)	337.3(19)	341.2(11)	346.0(42)	348.4(25)	356.5(11)
10+	--	340.4(47)	342.0(228)	342.0(347)	344.2(20)	350.7(228)	352.3(277)	358.7(32)

*( ) Number of fish per sample.

Table 20. Relative rate of increase in total length of herring cohorts captured by trap fishermen of the Magdalen Islands.

AGE	YEAR						
	1973-4	1974-5	1975-6	1976-7	1977-8	1978-9	1979-80
2-3*	55.93	-6.93	**	--	18.03	9.02	16.51
3-4	--	9.84	34.75	8.32	8.58	9.07	10.00
4-5	8.89	7.04	2.65	5.42	4.19	5.14	8.04
5-6	6.64	5.80	0.61	6.35	5.08	4.28	6.54
6-7	2.26	3.48	--	--	3.23	3.21	6.72
7-8	0.31	2.61	0.70	--	--	3.19	4.33
8-9	-1.58	-0.09	2.12	3.52	--	2.29	4.06
9-10+	0.70	3.48	1.45	2.05	2.78	1.82	2.96

* based on fewer than 11 observations.

** based on no data.

Table 21. Mean weight (g.) of herring from samples from traps in the Magdalen Islands, 1973-1980.

	1973	1974	1975	1976	1977	1978	1979	1980
Mean weight	259.6	267.8	282.7	261.9	221.8	229.2	274.2	264.6
	(117)[1]	(698)	(600)	(698)	(100)	(1277)	(1099)	(600)

[1] number of fish in the sample.

Table 22. Catch at age (numbers) and age composition (%) of herring caught in Magdalen Islands traps, 1973 to 1980.

Age	1973	1974	1975	1976	1977	1978	1979	1980
				Catch at age (1000 No)				
2	--	99	--	--	81	--	6	--
3	--	296	58	--	1623	423	28	14
4	--	494	292	580	1461	1004	73	55
5	693	395	175	670	1380	132	192	15
6	2542	1580	467	134	487	185	17	31
7	5085	988	1226	--	--	106	51	6
8	1849	2273	526	580	--	79	11	8
9	1387	2371	409	89	1217	106	17	4
10+	--	1383	2686	2410	1867	608	169	20
				Age Composition				
2	--	1		--	1	--	1	--
3	--	3	1	--	20	16	5	9
4	--	5	5	13	18	38	13	36
5	6	4	3	15	17	5	34	10
6	22	16	2	3	6	7	3	20
7	44	10	21	--	--	4	9	4
8	16	23	9	13	--	3	2	5
9	12	24	7	2	15	4	3	3
10+	--	14	46	54	23	23	30	13
Mean age	7.5	7.6	8.3	8.1	6.2	5.8	6.6	5.7

Table 23. Number of traps set and licenced in the Magdalen Islands.

	Year										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
No. set	23	22	31	33	33	28	29	25	18	21	19
No. licenced	23	23	31	33	33	28	30	31	29	22	22

Table 24. CPUE index (t/trap) for the trap herring fishery of the Magdalen Islands as determined by landings in tons divided by the number of traps in operation.

	Year										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
CPUE	204.8	328.8	123.3	90.9	80.2	59.0	40.3	72.0	33.6	7.3	2.1
	(23)	(22)	(31)	(33)*	(33)	(28)	(29)	(25)	(18)	(21)	(19)

* ( ) number of traps.

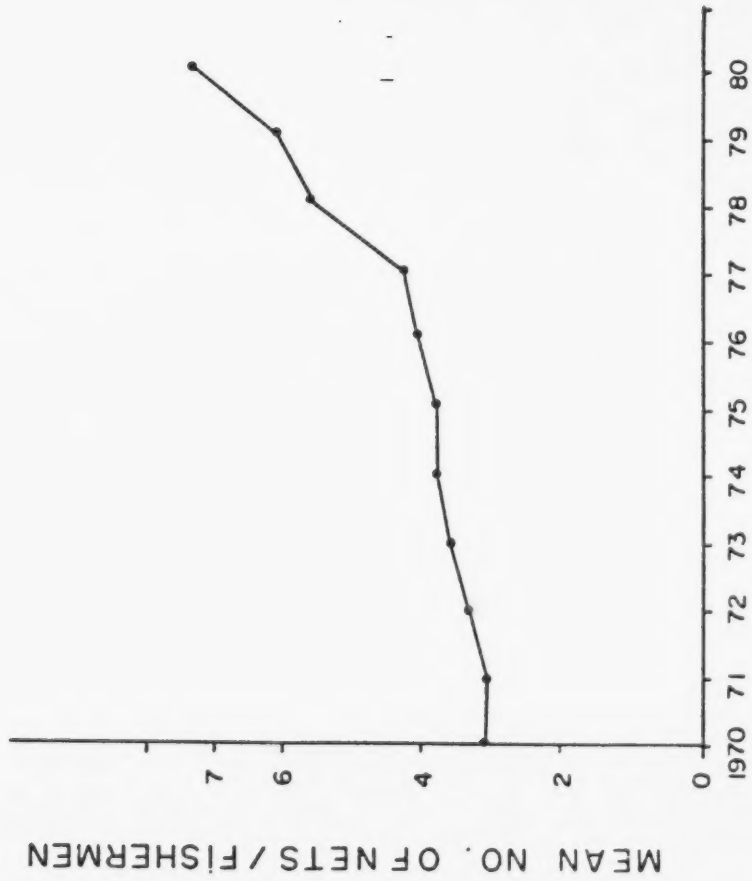

Fig. 1. Mean number of herring gill nets per fishermen of the Magdalen Islands (1970-1980).

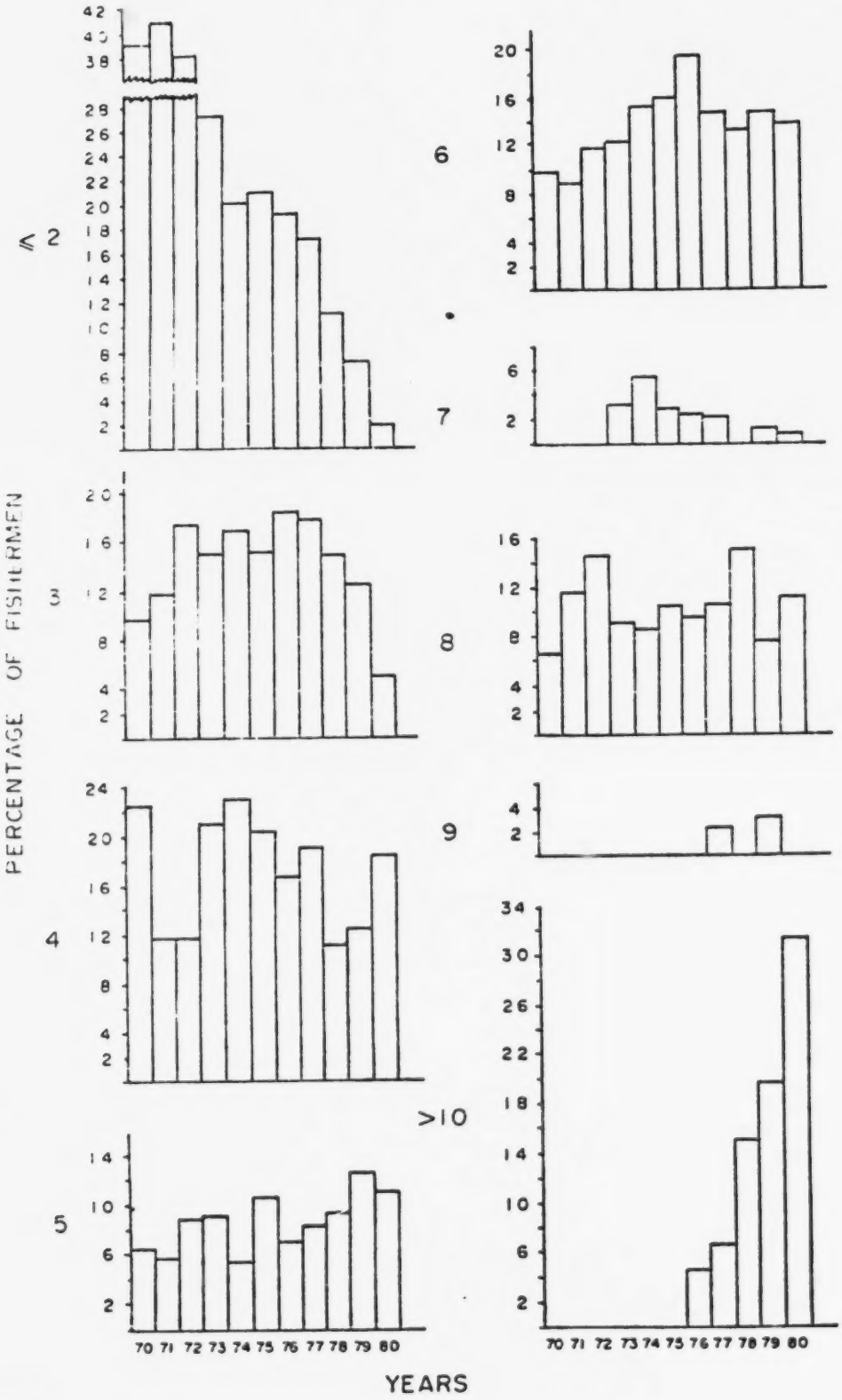

Fig. 2. Number of fishermen setting from one to ten or more nets per year, in the Magdalen Islands.

Fig. 3. Map of Magdalen Islands (after Spénard, 1979). Arrows indicate locations where at least one trap was operational during 1970 to 1978.

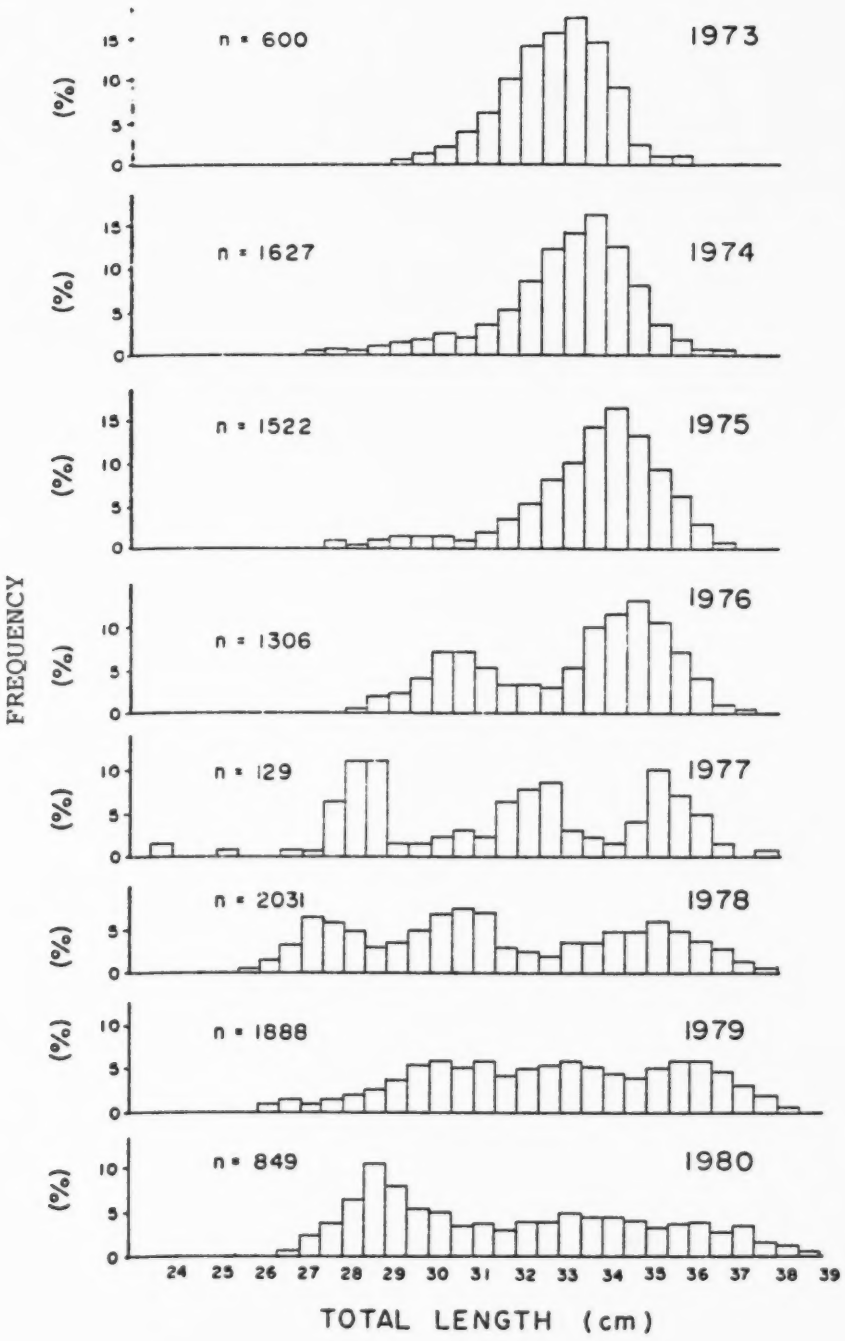

Fig. 4. Length frequency for herring caught in the Magdalen Islands traps.